Scale, Essential Fish habitat and Watershed Management of Gulf Fisheries: a conceptual viewpoint.

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Conservation of aquatic resources requires management of both fishing effort and the mosaic of habitats used by nekton that sustain fisheries production. Within this context, "environment" is viewed as the sum of the abiotic and biotic surroundings, including habitat and other organisms, whereas, "habitat" is viewed as the localized structured component which acts as a templet of organization and attractor for nekton. Although there is much debate, it is generally believed that nekton survival depends upon approaching their physiological optima first and then behaviorally searching out the appropriate life-stage-dependent habitat. Deviation from the optimal environment increases mortality and/or decreases production. This conceptual view possesses both dynamic (physical-chemical) and stationary (structural) components. Young estuarine-dependent nekton respond hierarchical to environmental conditions which will "deliver" them into the optimal nursery zones within the landscape leading to higher survival, growth, and production. Variability in seasonal and annual climatic conditions, anthropogenic alteration of watersheds such as freshwater withdrawal and reservoir development, coupled with large-scale ENSO/LaNiña events, influence recruitment and can shift the position of the dynamic component such that it either does not overlap the stationary component or does so infrequently and only to a small degree. Under these conditions, habitat is considered a limiting factor when these two components are spatially/temporally uncoupled or when access to the structural component is lost due to development or anthropogenic impacts. Habitat alteration due to bulkheading and filling eliminates or severely reduces access to intertidal salt marshes which are vital to estuarine ecosystem processes. These anthropogenic activities also lead to habitat fragmentation, a change in the spatial arrangement of this important habitat along the estuarine axis, and potentially to shifts in the source/sink balance of the estuary. Additionally, introduction of non-native (Tilapia) or highly invasive (*Phragmites*) aquatic species can also change interactions with the stationary component of the mosaic by young nekton by altering species interactions (competition and predation) and access to intertidal salt marshes. These changes can alter ecosystem health, dynamics, and ultimately productivity. Understanding linkages between the dynamic and stationary components of the environment is an important step in the process of developing prudent management strategies in aquatic landscapes. My focus is to present a conceptual model which links the environment-habitat mosaic with production, and to provide data on the impact of habitat loss as a direct recruitment bottleneck. This approach is valuable for 1) predicting the outcome of perturbations, 2) development of a better understanding of the linkages between environmental components resulting in a clearer understanding of "essential" vs "critical" habitat, and 3) providing a basis

to target future research using a more holistic approach.